Orchestrating Aerospace Control

Aerospace control normally should be a commander's first campaign priority. This role deserves special emphasis for at least three reasons. First, control makes it possible to perform aerospace force enhancement missions, especially reconnaissance and surveillance, without unacceptable interference while simultaneously denying the enemy the same opportunity.[1] Second and for the same reasons, control makes possible the aerospace force application role while making it more difficult for enemy aerospace forces to apply firepower against friendly surface forces.[2] Third, aerospace control permits friendly surface forces to operate more effectively and denies that advantage to the enemy. In classical military terms, aerospace control magnifies the enemy's fog and friction while reducing friendly fog and friction.

Although aerospace forces can operate to some extent without positive control of the medium (using terrain-masking, standoff, and other techniques), increasing the degree of control permits higher-tempo operations, opens more options, and makes it easier to seize and maintain the initiative. Gaining contested aerospace control requires the application of combat power against the opponent's aerospace forces. The counterair and counterspace missions are rubrics for a host of sub-missions (e.g., offensive and defensive counterair and counterspace, suppression of enemy air defenses, strategic air defense, ballistic missile defense) that are the commander's primary means for employing that power. However, other aerospace missions and surface force operations can also make important contributions. Commanders must decide how to employ these missions and develop the appropriate synergies on a case-by-case basis by assessing the host of factors that determine if, when, where, and how counterair and counterspace missions can and should be conducted. The result of this assessment should be a concept of operations that provides friendly forces with the best chance of gaining and maintaining aerospace control. The concept of operations

also should prepare friendly forces to exploit opportunities created by that control.[3]

Degree of Control

Aerospace control is rarely absolute. The nature of aerospace power enables an enemy possessing a relatively small aerospace force to pose a significant threat, a situation analogous to the naval concept of a "fleet in being."[4] Moreover, aerospace forces are unlike surface forces in that it is much more difficult, if not impossible, to neutralize them through isolation.[5] As a result, the struggle for control can be lengthy, continuing throughout a campaign.[6] Thus, in developing a concept of operations, commanders must assess the degree of control needed. They then must make provisions to attain the required control through sustained or repeated operations.

The degree of control required depends on the nature of the entire theater campaign. For example, if campaign success depends on complete surprise, then near absolute control at specific points and times may be necessary to prevent observation by enemy aerospace forces. Likewise, highly vulnerable amphibious and airborne operations require a higher degree of aerospace control than does the well-concealed maneuver of an army through a jungle.

The degree of aerospace control is increased by increasing enemy losses to the point the enemy is unable or unwilling to conduct aerospace operations. Yet, enemy losses cannot be the sole consideration. The commander must also take into account both the amount of resources he devotes to the aerospace control effort and the losses he experiences. While an obvious concern is the physical cost (lives and resources) of friendly losses, particularly in an era of very limited numbers of aerospace assets, another concern must be the psychological cost. Psychological cost can be especially debilitating when losses are due to fratricide.

Fratricide can lead to a breakdown in the trust between friendly forces that is an essential part of the morale and motivation needed to achieve success in war.[7] Commanders must make great efforts to

reduce the risk of fratricide while at the same time realizing that there may be situations that require accepting higher degrees of risk.

Offensive Operations

Although aerospace control might be maintained through defensive actions (e.g., the Battle of Britain), offensive operations must be undertaken if a commander is to seize control of contested airspace. An advantage of offensive action is that the enemy's loss of the initiative compels him to react and often reduces the time he has to make decisions and plans. In addition, possession of the initiative allows a commander to create and exploit enemy uncertainty while reducing, if only slightly, his own.

Offensive operations must be persistent, providing the enemy with little opportunity to preserve or rebuild forces. Persistent Allied offensive operations in World War II gave the Germans and Japanese little opportunity to recover from the attrition their air forces had suffered. As a result, the quality of German and Japanese aircrews progressively declined, which led to even higher losses, which further lowered their air forces' ability to recover.[8]

Maintaining pressure on the enemy through offensive operations can be especially difficult when the enemy operates from a sanctuary. The enemy's safe haven deprives the commander of the options of destroying enemy aerospace forces at their bases or even in the airspace of the sanctuary. Thus, a sanctuary gives the enemy the ability to preserve forces by refusing combat. In these circumstances, only offensive operations against targets outside the sanctuary that the enemy feels obligated to defend are likely to cause him to fight. The problems in finding targets the enemy will defend and then causing him to commit forces to battle at a disadvantage were apparent during the Korean War's air operations in the vicinity of the Yalu River.[9]

Beyond these general considerations, a commander must evaluate a number of elements peculiar to the specific situation if offensive operations are to be successful. Among the most important are

warning and control systems, air bases and launch facilities, surface-based defenses, and aerial combat. The commander should, of course, assess these elements in terms of both friendly and opponent forces.

Warning and Control Systems

A commander should carefully assess the enemy's warning and control systems to determine whether they are likely to hinder offensive operations unacceptably. Warning and control systems are especially important because they determine the enemy's ability to detect and react to attacks.[10]

Examining a system's redundancies aids in estimating the feasibility of degrading its operation by destroying various elements. Since many elements of a warning and control system rely on use of the electromagnetic spectrum, friendly use of the spectrum (countermeasures) and of low-observable technologies (as in Desert Storm's use of EF-111 and F-117 aircraft) provide alternatives to destruction as a means for degrading system effectiveness.[11] Often, ability to degrade the operation of an enemy's warning and control systems is improved when the commander integrates offensive surface operations with counterair missions. Employed offensively, friendly surface forces can capture or destroy elements of the enemy's systems. Surface forces can also seize locations that provide the best vantage points for surface-based warning and control systems. The mere threat of surface force employment can have an important impact by making it necessary for elements of the enemy's systems to be mobile (mobile equipment performance is usually below that of fixed equipment). In addition, the enemy's need for mobility may force him to locate elements in positions that provide less than ideal vantage points and mutual support.

Air Bases and Launch Facilities

Air bases and launch facilities can be an extremely lucrative class of targets for offensive counterair and counterspace missions for both obvious and not-so-obvious reasons. Aircraft on air bases are often

more concentrated and vulnerable than they are in flight. These factors may make destroying them at their bases much easier than destroying them in aerial combat. Attacks on bases crowded with aircraft can have devastating results in the struggle for control of the air. The success of the Japanese attack on air installations in conjunction with their Pearl Harbor raid is an example. A decisive example occurred at the beginning of the Six-Day War in 1967 when a surprise attack by Israeli aircraft virtually destroyed the Egyptian air force before it could get off the ground. The most recent example happened in Desert Storm. In this case, the Iraqis attempted to preserve their air force by hiding aircraft in hardened shelters, but precision attacks against the shelters defeated this option.

If the attacker does not catch aerospace forces on the ground, destruction of critical base facilities can still be decisive. When air bases or space launch facilities cannot provide landing, launching, or critical support (e.g., maintenance, fuel, munitions), aerospace forces are effectively grounded. Merely reducing the number of operable bases causes overcrowding and overtaxes surviving bases, thereby degrading capabilities while making these overcrowded facilities even more lucrative targets. Further, as the number of operating bases and launch facilities is reduced, it becomes easier to concentrate attacking forces on these targets.[12]

There are other, less obvious, considerations concerning bases and launch facilities that should shape the struggle to control the aerospace environment. The location of bases, for example, may determine whether specific aircraft can reach particular targets, with what payload, how quickly, how frequently, and with what persistence. Thus, the relative location of friendly and enemy aerospace facilities can shape the struggle for control in terms of targeting priorities as well as in terms of force structure required.[13]

The same factors that make base and launch facility location important to the aerospace control struggle can be imperatives in designing an entire theater campaign. In some circumstances, theater campaigns (aerospace and surface) have essentially been struggles to attain air bases.[14] In this light, capture of enemy air bases rather than

their destruction can be particularly important. Capturing bases brings friendly air forces closer to the enemy (with attendant increases in sortie frequency, responsiveness, etc.), increases the number of operating bases available (with attendant increases in flexibility and decreases in vulnerability to air base attacks), and reduces the bases available to the enemy (thus decreasing enemy flexibility and increasing vulnerability).

These advantages could be negated if aerospace forces become more vulnerable as they move closer to the enemy. However, increases in vulnerability do not always follow such movements. Improvements in the ability of aerospace forces to operate effectively may make it possible for a commander to gain and maintain the initiative, reducing or even preventing the enemy from exploiting the opportunity provided by the proximity of bases.[15]

The problems arising from unfavorable base location can be mitigated by the use of long-range aircraft,[16] but these aircraft can create their own problems in terms of loiter times, responsiveness,[17] and vulnerability.[18] Air refueling also can ease base location concerns although air refueling increases the complexity of each mission with attendant command and control problems and increased risk factors.[19]

Surface-Based Aerospace Defenses

Enemy surface-based aerospace defenses are still another important factor that a commander should consider when determining how to use offensive operations to gain control of the aerospace environment. Enemy surface-based defenses not only can degrade aerospace operations by destroying platforms, the threat they pose may force aircraft to fly lower, faster, and over different routes; thus reducing range, payload, endurance, communications capability, and ability to find targets. Enemy defenses can further reduce a commander's offensive capability if they cause him to dedicate forces, which otherwise could be used for attacks against air bases and launch facilities, to defense suppression.

A commander contemplating offensive operations should evaluate how the interaction of the numbers, locations, and individual

characteristics of elements of enemy surface-based defenses influence the effectiveness of those defenses. Similarly, the commander should be aware of how orchestrating aerospace and surface forces in offensive operations can hinder enemy performance by interfering with this interaction. Surface forces can be an especially effective means for degrading the enemy's surface-based aerospace defenses because such defenses often are vulnerable to surface attack. The Israeli army's maneuver across the Suez Canal during the 1973 war had the additional—perhaps unintended—bonus of exploiting the vulnerability of Egyptian surface-to-air missile sites to ground attack, enabling Israeli air operations to become even more effective.[20]

Enemy surface-based defenses may rely on electromagnetic systems for target acquisition, identification, and control. If they do, a commander can exploit this dependence by disrupting the enemy's use of the spectrum (e.g., jamming) or by using the enemy's reliance on the spectrum to locate and destroy key elements in the defensive system (e.g., with antiradiation missiles).

Destruction in the Air

The previous paragraphs have served as reminders that often overlooked actions can play a significant role in seizing control of the aerospace environment. At risk of being lost in the discussion is the traditional role of air-to-air combat (perhaps space-to-space combat in the future). Clearly, something must be said about attacking the enemy in the air although the tactical considerations are beyond the scope of this essay.

Although attacking the enemy in the air may not always be as efficient as other offensive operations, it does offer the opportunity to destroy both enemy platforms *and their crews*. The extensive time and resources required to produce well-trained crews may make their loss far more important than the loss of aircraft. In addition, loss of personnel is likely to degrade the morale and tactics of surviving crews, allowing this approach to have an effect well beyond the physical destruction it achieves.[21]

Creating conditions that make it possible to inflict such destruction poses significant challenges. Bringing the enemy force to battle when, where, and under the conditions desired defines the exercise of the operational art.[22]

Defensive Operations

Despite the need to gain aerospace control, a commander may find that offensive operations are not immediately feasible. The enemy may possess the initiative. Even when friendly forces possess the initiative, the nature of aerospace power usually provides the enemy with the ability to conduct some offensive operations. Thus, the ultimate success of a campaign may depend on a commander's ability to conduct effective defensive operations.

Situation

The emphasis a commander gives defensive operations should be derived from careful consideration of the current and evolving situation. Some operations may require so much protection that a commander must temporarily emphasize defensive operations over offensive operations.[23] There may be periods during a campaign, perhaps following a high-tempo advance, when a commander must emphasize defensive operations while rebuilding the strength of friendly forces and bringing forward vital support.

Defensive Considerations

When commanders employ aerospace forces in defensive counter aerospace missions, they should concentrate on defeating the enemy's ability to seize or maintain the initiative. The objective is to make the enemy's attacks too costly for the results they achieve.[24] To create this condition, commanders must assess the same factors vital in conducting offensive operations (bases, warning and control systems, surface-based defenses, air-to-air combat) but, in this case, they should consider the factors from the opposite perspective.

In conducting defensive operations, a commander's objective involves providing friendly forces with advantages that give them the best chance

of inflicting high losses with the least risk. No defensive system is perfect, and high enemy losses, alone, may not be sufficient to deter enemy attacks. Therefore, commanders should take all appropriate actions to reduce the results the enemy's attacks achieve (passive defense). Finally, in a defensive mode, commanders may be faced with the prospect of leaving some targets undefended in order to mass forces to defend other targets. Attempting to defend everything can so dilute strength that nothing is defended well.

Conclusion

Securing control of the aerospace environment can be the most difficult and important challenge a commander faces. There is no standard formula or recipe for success. Achieving aerospace control involves not only the orchestration of aerospace forces but also often requires their synchronization with surface forces. In spite of the difficulties, aerospace control must be gained and maintained. Without it the theater campaign is unlikely to succeed.

Notes

1. For example, during the Normandy invasion, Allied control of the aerospace environment over Great Britain and the English Channel prevented the Luftwaffe from providing information that would have exposed the Fortitude South deception. Charles Crickshank, *Deception in World War II* (Oxford: Oxford University Press, 1979), 170–89; and Wesley F. Craven and James L. Cate, eds., *The Army Air Forces in World War II,* vol. 3, *Europe: ARGUMENT to V-E Day, January 1944 to May 1945* (Chicago: University of Chicago Press, 1951; new imprint, Washington, D.C.: Office of Air Force History, 1983), 143, 181.

2. For example, aerospace control was the key to the ability of the Allied air forces to interdict the German army's maneuver in France in 1944. Control also prevented the Luftwaffe from interdicting the maneuver of Allied armies. As a result, the Allies were able to build up their strength faster than the Germans. Gen Omar N. Bradley et al., *Effect of Air Power on Military Operations: Western Europe* (Wiesbaden, Germany: 12th Army Group, 15 July 1945), 18–23, 59.

3. For a discussion of the importance of a commander's concept of operations, see Gen William E. DePuy, "Concepts of Operation: The Heart of Command, The Tool of Doctrine," *Army*, August 1988, 26–40.

4. During the Iran-Iraq War, despite having a relatively small number of aircraft capable of making standoff missile attacks, Iraqi airpower posed a significant

interdiction threat to tankers carrying Iranian oil. Similarly, during Operation Desert Storm, Iraqi's Scuds posed a strategic threat (especially to Israel), whose magnitude had not been anticipated before hostilities commenced.

5. The Battle of the Bismarck Sea demonstrated to the Japanese that maneuvering forces across bodies of water where they possessed insufficient control of the air posed great risks. Thus, the Japanese loss of control meant that the Allies were able to bypass and neutralize large numbers of Japanese ground forces without having to fight them. In contrast, surviving Japanese air forces in these areas, like those based in New Guinea, had a much better chance of being safely maneuvered to an area under Japanese control. Craven and Cate, vol. 4, *The Pacific: Guadalcanal to Saipan, August 1942 to July 1944*, 615–70.

6. This is one of the central themes of Williamson Murray, *Strategy for Defeat: The Luftwaffe, 1933–1945* (Maxwell AFB, Ala.: Air University Press, January 1983).

7. The loss of Allied troop transports to friendly surface-based air defenses during Husky Number Two in the invasion of Sicily is one example. Of 124 aircraft, 50 were damaged and 11 destroyed by friendly fire. In addition, friendly fire caused 27 aircraft to return to base with full or partial loads. Craven and Cate, vol. 2, *Europe: TORCH to POINTBLANK, August 1942 to December 1943*, 453–56.

8. For a discussion of the impact of aircrew attrition on German and Japanese air forces, see R. J. Overy, *The Air War, 1939–1945* (New York: Stein and Day, 1980), 141–45.

9. Robert Frank Futrell, *The United States Air Force in Korea, 1950–1953*, rev. ed. (Washington, D.C.: Office of Air Force History, 1983), 607–17.

10. The Battle of Britain clearly demonstrated the importance to defensive operations of using radar to vector fighters. For a German perspective on the advantages radar gave the British, see Cajus Bekker, *The Luftwaffe War Diaries*, trans. and ed. Frank Ziegler (New York: Doubleday & Co., Inc., 1968), 145–46.

11. The nature of aerospace power usually enables aerospace forces to be more effective than surface forces in disrupting the electromagnetic spectrum. Although surface jammers may be more powerful, they usually do not have the ability to disrupt warning and control systems the enemy uses to protect the aerospace environment deep in his rear area.

12. Dispersal provides an excellent means for avoiding the dangers caused by a crowded air base. For an excellent discussion of dispersal, see John M. Halliday, *Tactical Dispersal of Fighter Aircraft: Risk, Uncertainty, and Policy Recommendations* (Santa Monica, Calif.: RAND, February 1987).

13. During the North African campaign, Maj Gen James H. "Jimmy" Doolittle noted that the lack of suitable bases within reasonable range of the enemy meant that he could employ at one time only about a third of the 600 aircraft at his disposal. Craven and Cate, 2:115. In Korea, Brig Gen Edward J. Timberlake, deputy

commander of US Fifth Air Force, noted that "one F-51 adequately supported and fought from Taegu Airfield is equivalent to four F-80's based on Kyushu." Quoted in Futrell, 94.

14. The need to seize bases was emphasized in a lecture on World War II by Sir Arthur Tedder. He stated that

> in our discussions [during the North African campaign] my naval colleague was as insistent as I was in emphasizing to our army colleague the urgency of the recapture of the airfields in the Benghazi bulge. . . . The land-war in the Mediterranean became, in fact, a battle for airfields. When we lost airfields we lost the initiative on land and at sea.

Air Chief Marshal of the Royal Air Force Sir Arthur Tedder, "Air, Land and Sea Warfare," *Journal of the Royal United Service Institution*, February 1946, 63. Learning from the Allies' experience in North Africa, the US Ninth Air Force paid great attention to the subject of air base availability in its preparation for the invasion of France. After the war, its analysis noted,

> Mobility, closely analogous and second in importance only to flexibility, is another prime prerequisite. To a tactical air force mobility on the ground is what flexibility is in the air. Fundamental to the mobility of a tactical air force is the provision of airfields where, when, and of the types required by the tactical commands and administrative elements most effectively to carry out their respective tasks.

Col William B. Reed et al., eds., *Condensed Analysis of the Ninth Air Force in the European Theater of Operations* (Washington, D.C.: Office of Air Force History, 1984), 3. Operations in the Pacific in World War II, such as those at Guadalcanal, were mainly driven by the need to seize air bases. See Lt Gen Miyazaki Shuichi, "Personal Experiences during the Solomons Campaign," United States Strategic Bombing Survey, Military Analysis Division, *The Effect of Air Action on Japanese Ground Army Logistics* (Washington, D.C.: Government Printing Office, April 1947), 174–80. In his *Report of the Commanding General of the Army Air Forces to the Secretary of War*, 4 January 1944, 4; Gen Henry H. "Hap" Arnold noted,

> Modern war is for air bases; the bulldozer must accompany the plane. . . . One of the elements of victory in North Africa was the speed with which our aviation engineers constructed airfields behind the front lines and pressed the attack. . . . In North Africa, captured airfields were put in usable condition in a day or two. In the Aleutians, engineers built airfields down the island chain, and when they had completed a base on Amchitka—just 69 miles from Kiska—the Japs began to realize that Kiska was no longer tenable.

15. This was the case in World War II with the forward bases Gen George C. Kenney built in the Pacific and the Allies built in Normandy. It was also true for US bases in Korea and Vietnam.

16. The long range of US bombers and escort fighters was the reason the Allies were able to gain air superiority over France before they landed in Normandy. Craven and Cate, 3:3–66.

17. The need to react speedily to surface battle developments was one of the reasons why bases in Great Britain were not sufficient once the Allies landed ground forces in France.

18. B-52 losses were a key consideration during Linebacker II. See Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, 1989), 187.

19. For example, US air refueling capability decreased the need for nearby air bases in conducting attacks on North Vietnam, Libya, and most recently Iraq.

20. The attack by General Sharon's forces at the junction of Egyptian forces along the Suez neutralized four surface-to-air missile sites. Their loss created a gap in Egyptian surface-based air defenses the Israeli air force was able to exploit to regain control of the aerospace environment. M. J. Armitage and R. A. Mason, *Air Power in the Nuclear Age* (Urbana, Ill.: University of Illinois Press, 1983), 134.

21. The loss of trained aircrews, not aircraft, was the critical concern of British leaders during the Battle of Britain. Ultimately, the lack of trained crews, not aircraft, was the weakness that caused the defeat of the Axis air forces. Overy, 32–34, 141–45. During the 1982 Lebanon air war, the Israeli air force's demonstrated ability to inflict high losses appears to have caused surviving Syrian pilots to behave "as if they knew they were going to be shot down and [they] waited to see when it was going to happen and not how to prevent it or how to shoot us [the Israelis] down." Benjamin S. Lambeth, "Moscow's Lessons from the 1982 Lebanon Air War," in *War in the Third Dimension: Essays in Contemporary Air Power*, ed. Air Vice-Marshal R. A. Mason (London: Brassey's Defence Publishers, 1986), 132. Similarly, during Desert Storm the threat of destruction in the air seems to have deterred the Iraqi air force from flying, except to escape into Iran.

22. Bringing the enemy to battle under the best possible conditions for friendly forces often requires orchestrating aerospace and surface forces to create a dilemma for the enemy. The Allied invasion of France provides a rich example. The threat posed by the landing made it necessary for the Germans to commit their air force to battle in an attempt to prevent defeat on the ground. Anticipating this reaction, the Allies had attacked German air bases and their warning and control systems within a 150-mile radius of the landing area. Thus, the Allies ensured the Luftwaffe would fight at such a disadvantage that it could not gain sufficient control to prevent defeat on the ground. Craven and Cate, 3:69.

23. Airlift operations are so vulnerable to air attack that success can easily depend on how well they are protected. The German reinforcement by air of Stalingrad provides an example of what happens when protection is inadequate. Bekker, 278–94. This can also be the case with carrier operations as the Marines discovered at Guadalcanal.

24. The Battle of Britain provides one example, US attacks on Schweinfurt another.